DOCUMENT RESUME

ED 236 555 CS 007 342

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TITLE Beyond the Computer: Reading as a Process of Intellectual Development.
PUB DATE Oct 83
NOTE 25p.; Paper presented at the Annual Meeting of the North Central Reading Association (26th, Minneapolis, MN, October 28-29, 1983).
PUB TYPE Information Analyses (070) -- Viewpoints (120) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Cognitive Development; *Computer Assisted Instruction; Computer Programs; Computers; *Critical Thinking; Educational Trends; Elementary Secondary Education; Higher Education; Imagination; *Independent Reading; *Reading Achievement; Reading Centers; Reading Habits; *Reading Instruction; Recreational Reading; Student Motivation; Student Teacher Relationship; Teaching Methods; Technological Advancement

ABSTRACT

With more than 100,000 computers in public schools across the United States, the impact of computer assisted instruction (CAI) on students' reading behavior needs to be evaluated. In reading laboratories, CAI has been found to provide an efficient and highly motivating means of teaching specific educational objectives. Yet, while computer technology may improve students' reading skills, it cannot inspire the desire to read independently. That desire is the product of personality traits, family characteristics, and motivational factors such as teacher encouragement, campus stimulation, and the need for self-gratification. Individual initiative, thoughtful contemplation, and the power to reason things out after reading about and studying a topic are all beyond computer technology. The business of education is to turn out students with imagination, desire, and the capacity for choice. If used indiscriminately, computers may prove to foster restricted and mechanical patterns of thought. (MM)

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Beyond the Computer:
Reading as a Process of Intellectual Development

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presented to the

NORTH CENTRAL READING ASSOCIATION
26th Annual Conference
Hyatt Regency Hotel
Minneapolis, Minnesota

October 29, 1983

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ABSTRACT

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Recent technologies for helping or assisting reading specialists, such as the computer, can alter the reading-learning process. When technical advances are made, human patterns may be modified in subtle ways. The challenge for educators is to utilize technical devices without becoming too dependent on them. The goal is an informed person who will continue to learn, not a more efficient way to catalog data or grind out diplomas.

This paper attempts to explain how reading and the involved process of reading may be utilized to promote a range of ideas and enhance intellectual development. Reading and study skills specialists, using sophisticated techniques such as computer technology, are frequently too busy developing basic skills, and they cannot at the same time give emphasis to intellectual development. This intellectual activity through the process of reading and critical discourse is usually left to classroom specialists. Perhaps reading as a medium for intellectual development should be given more exposure and attention in the developmental laboratory.

Beyond the Computer:

Reading as a Process of Intellectual Development

One year after the death of Napoleon Bonaparte in 1822, a brilliant but cantankerous mathematician named Charles Babbage completed the construction of an advanced adding machine. Babbage first wrote about his new device in 1833. He initially called it a difference engine and later referred to it as the analytical engine. This machine has been acknowledged as the world's first universal digital computer. The British government subsidized the task of building a full-scale version.[1]

Babbage worked on his machine for nearly 40 years. As an interesting footnote, Lord Byron's beautiful and mathematically gifted daughter, Ada, became Babbage's confidante and public advocate. The Pentagon recently named a computer language after her. Ada will replace eight separate languages being used by the three military services.[2]

The computer may have had its beginnings in the nineteenth century, but it did not become a well-known or understood technical instrument until after World War II. The need for computer technology to control and predict became quite obvious as our scientific talent produced more complicated and demanding technical devices. Computers have been identified as the central nervous system of a high technology environment.

The remarkable achievements of science from 1650 to 1800 characterize what is known as the Age of Reason. These scientific developments are the basis of modern high technology. Technology embodies physically what science has already done. The word technologist was coined in 1854.[3] In 1859 Charles Darwin's Origin of Species appeared. In 1866 Nickolaus August Otto and Eugen Langer were building a practical internal-combustion engine in Germany. In the 1870s James Clerke Maxwell developed the theory of electromagnetism. Wilhelm K. Roentgen discovered the x-ray in 1895.

It has been said that the nineteenth century represents the great potential of technology.[4] If this is true, it might be appropriate to say the twentieth century represents some serious failures of technology. Nuclear weapons and uncontrolled toxic chemical waste are good examples. About 80 years ago George Santayana said with considerable foresight, "The possibility of essential progress is bound up with the tragic possibility that progress and human life shall some day end together."[5]

In many ways our sophisticated technical achievements in the post-World War II era are due to computer technology. The first electronic digital computer in the United States was unveiled at the University of Pennsylvania in 1946. It was a collection of 18,000 vacuum tubes, 70,000 resistors, 10,000 capacitors and 6,000 switches; it occupied the space of a two-car garage.[6] Within a few years Bell Labs built the first

solid-state (transistorized) computer, and the high-tech boom started. Computer technology is used for: guidance of missiles, space travel, fuel efficiency controls on automobiles, medical research, managing payrolls, checking inventories, collecting, storing, and making calculations with extremely large amounts of data. These uses represent only a small portion of computer applications.

In the early 1950s the National Bureau of Standards, about 30 miles north of Washington, D.C. near Gaithersburg, Maryland, had a sophisticated computer known as the Washington Oracle. This Washington Oracle is said to have made the decision to recall General MacArthur from Korea after it calculated equations containing strategic and economic variables of his plan to bomb China. The largest and most advanced computers now available to any government bureaucracy on earth are thought to belong to the National Security Agency located at Fort George C. Meade, an Army base seventeen miles northeast of Washington, D.C. They have:

> Computers to break codes. Computers to direct spy satellites. Computers to intercept millions and millions of electronic messages transmitted by friends and enemies from every corner of the globe. Computers to recognize certain target words in spoken communications. Computers to store, organize and index all this information so it can be retrieved when needed.[7]

The most recent and perhaps most spectacular innovation in computer technology has been miniaturization along with reduced production costs. If automobiles benefitted from technical

improvements the way computers have, it is estimated a Rolls Royce would now cost $2.75, get 3,000,000 miles to a gallon of gasoline, and have the power to propel an ocean liner.[8] To emphasize this revolution in computer technology Time magazine's Man of the Year for 1982 is not a person; it is a machine, the computer.[9]

There are now more than 100,000 computers in our public schools (one for every 400 pupils) compared to 52,000 only 18 months ago. Within five years this number is expected to surge to 2,000,000. A University of Minnesota study projects that 85 percent of the nation's school districts will have computers available to students this school year.[10] Minnesota leads all other states with one computer for every 50 students and a locally produced collection of 700 software programs.[11] The Minnesota Educational Computer Consortium, a nonprofit state-run organization, designs its own software.[12]

These dynamic technical expansions continue to grow with almost certain penetration into all school systems. "Science teaches us to bow before the facts, however insignificant the fact may seem."[13] Technology speeds this process. In other words there seems to be an urgent, vacuous demand for computers in public school systems based on the technical ethos of efficiency.

Introduction

For reading and study skills specialists within higher education, computer technology may be able to supply a needed assist to overworked professionals with serious problems. "Its capacity for almost infinite memory, its flexibility and responsiveness to the learner make it the most enticing technological advance in education."[14] But there are many tough questions to answer. Does computer technology enhance or restrict intellectual development? Can computer-assisted instruction (CAI) make a difference with severely handicapped readers? Can students learn to debate or challenge the decision of a machine? Do students learn to be submissive in the presence of a computer?

It may be difficult to know exactly what the educational pitfalls of CAI are. Experience with CAI in college reading labs is somewhat limited due to specialized software needs and lack of wide acceptance. It is known from industry that video display terminals (VDTs) are associated with four broad categories of health problems: alleged radiation hazard, visual disturbances, muscular-skeletal difficulties, and job stress. Educators need to be aware of these potential problems if students use visual display terminals for extended periods of time. In industry VDT workers usually find their jobs to be enjoyable, but 75 percent have physical or stress-related complaints attributable to the use of the terminal.[15]

Most universities and colleges are using some elements of computer technology to support reading and study skills centers. This includes everything from collecting and making calculations with data to using programmed instructions on video terminals. Two-thirds of senior high schools have microcomputers available for instruction, using them most frequently to teach computer science. About six percent of senior high schools in this country have computers (microcomputers) available solely for remedial use.[16]

Nearly 20 years ago Raymond E. Callahan wrote a book titled Education and the Cult of Efficiency. Callahan was somewhat ahead of his time when he pushed the thesis of industrial efficiency corrupting educational values. "In American education," he said, "it is important to be able to say that one's school system is abreast of the latest developments."[17]

Being abreast of the latest developments does not necessarily contribute to a student's education. The Carnegie Foundation for the Advancement of Teaching recently commented on the history of classroom technical innovations: "Virtually every new piece of hardware introduced into the schools in the past three decades has been oversold, misused and eventually discarded."[18] Academic hoop-jumping with machines cannot be defended with the argument that ignorance will be the lot of those who have not been put through it.[19] In the case of computer technology, it only gives us back ourselves. "It is a faithful mirror that reflects the

human traits that are brought to it."[20] The computer might give back to us the face of arrogance, of ruthlessness, and the lust for power.

William Barrett has identified a key point for educators within a high technology environment. He said, "The difficult thing is to condition people in some positive way that will lead them to be free to develop whatever possibilities they have."[21] This thought is not a new concept for educators. Indeed, reading and study skills teachers are quite sensitive about their unique responsibilities as educators. But how sensitive is the computer? Many people consider the computer, an electro-mechanical machine, to be nearly infallible. Ludwig Wittgenstein, speaking with a highly suspicious tone on the topic of certainty, once said, "At the foundation of well-founded belief lies belief that is not founded."[22] Computers distribute well-founded beliefs.

Computer Efficiency and Reading

Michael L. Kamil has identified three significant contributions to reading research from computer technology: data collection, analysis, and simulations (modeling and programming).[23] Computer technology has been able to help with data collection and analysis within many large institutions of higher education for nearly 25 years. Microcomputers now allow educational institutions with smaller budgets to have excellent computer facilities. Computer flexibility and responsiveness to teachers and students make it not only enticing but practical.[24]

CAI within the reading laboratory is a relatively new instructional technique, and in some quarters it is quite controversial. The first major efforts to use computers in teaching reading were those of the Brentwood Project, later called the Stanford Project. This initiative was launched in the early 1960s, and the computer did little more than allow for drill and practice on relatively isolated skills.[25] Considerable advances have been made since then. Current research by Steven A. Hillyard and Marta Kutas of the University of California at San Diego is attempting to identify brain-wave patterns with a computer. They want to be able to test a student's verbal skills with this brain-wave technique and identify those with reading disabilities.[26]

Due to computer sophistication and increased utilization, CAI seems to be on the threshold of universal use within educational institutions at all levels. Some claims have been made for the effects of CAI, but they are rather general and perhaps a little extravagant:

1. CAI can be used successfully to assist learners in attaining specified instructional objectives.
2. There is substantial savings in time (20-40 percent) for learning over traditional instruction.
3. Retention is at least as good, if not superior, to retention following conventioanl instruction.
4. Students react positively to good CAI programs.[27]

Researchers and practitioners have identified some problems with CAI by asking these questions:

1. What are the most effective CAI strategies? What is best in terms of feedback? Are different paradigms better for different areas?
2. How do individual learning styles interact with CAI? How much cognitive complexity can students handle?
3. What are the effects of individual learner characteristics in CAI situations (e.g. memory span, perception, I.Q., motor skills, sensory preferences, and literacy levels)?
4. What hardware configurations are most effective, efficient, or necessary? How important are audio outputs, touch panels, video capabilities, or light pens?
5. How does affect relate to CAI? What are the roles of motivation, persistence, delayed gratification, or locus of control?
6. What are the most effective strategies for program development? How should programmers and practitioners relate to each other?
7. What are the most effective strategies for integrating CAI with other instructional activities?[28]

According to Michael Kamil these aforementioned questions will shape the future of computers in reading instruction. Kamil's article, "Technology and Reading: A Review of Research and Instruction," is a significant contribution to the literature of computer assisted instruction.[29]

Another excellent monograph titled, "Computer Applications in Reading" by George E. Mason and Jay S. Blanchard presents a review of the history and use of computers.[30] They also describe some applications for reading instructors (comprehension, critical reading, drill and practice). With a dependence on visual effects, Mason and Blanchard wonder if computers are helping or hindering?

About 12 years ago Martha J. Maxwell wrote an article for the Journal of Reading Behavior titled "Skimming and Scanning Improvement: The Needs, Assumptions and Knowledge Base."[31] Maxwell identified what she believes are six myths about reading that prevent students from developing skimming and scanning skills. Her third myth states that one need not practice on machines to learn to skim and scan. Maxwell said, "It is common knowledge in the reading field that machines are not necessary adjuncts to improving reading rate and that their effects are primarily motivational."[32] Students must not become dependent on a machine warns Maxwell.*

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*Maxwell may have been thinking of projectors, accelerators, and tachistoscopes, but computers are also machines.

Perhaps some caution should be exercised by reading specialists when students exhibit a keen fondness for working with the computer or other mechanical aids. The goal is to read (books, periodicals or magazines) and think independent of computer-assisted programs. At some point teachers must unplug the computer and send their students off to read books.

There is some research that indicates teachers must be enthusiastic readers themselves in order to influence their students to read. Active adult readers, according to research findings, have been influenced by their parents, who read to them at an early age, who read themselves for enjoyment, and who owned many books.[33] For severely handicapped students who cannot read, teachers often function as a surrogate parent as well as learning facilitator. This parent role can never be accomplished by a computer.

Reading habits as a rule are not initially developed at the college level, but they must be nurtured in some way or another. Important skills that seem to precede lifetime reading habits are. critical reading, flexibility, and context vocabulary development.[34] Computer technology may help students with the ability to read but not with the desire to read independently. This desire to read involves a mixture of family characteristics, personality traits, and motivational factors (e.g., teachers, campus stimulation, and self-gratification or enjoyment). The business of education is to turn out students with imagination, desire, capacity for choice, and initiative or will.

Reading and Intellectual Development

Beyond computer technology are: individual initiative or self-motivation, thoughtful contemplation, and the power to reason things out after reading and studying on a topic. These human activities have been developed and used before computers came along. Reading as an intellectual activity obviously goes beyond the confines of a video terminal.

Making a bridge between the ability to read and intellectual development with books is a major hurdle. This problem is usually left to classroom instructors, but reading specialists understand their special obligation in this area. Some significant efforts have been made. Proceedings of the International Reading Association published in 1963 had as their conference topic Reading As An Intellectual Activity.[35] This was their primary concern. At this IRA meeting, Martha Maxwell said a complete reappraisal of goals and objectives within college reading programs is needed.[36] The idea was to expand reading's influence beyond narrow, remedial needs. This approach was welcomed, because it provided reading specialists with a challenging mission and opportunities to grow. But the self-motivated reader remains something of an endangered species.

It has been estimated that 20 percent of all readers account for 70 percent of all books read.[37] Readers of books, active readers, generally are better educated people compared to reluctant readers.[38] In a recent survey of retired teachers

and administrators belonging to the Teachers Insurance and Annuity Association (TIAA), 92 percent of the respondents indicated reading was a major leisure activity they enjoyed.[39] These respondents are educated people who worked as educators or administrators before retirement. Twelve years ago a national survey representing 36 colleges announced that professors averaged 26 hours reading each week (15 hours were spent with books). Students averaged 17 hours a week reading (11 hours for course work and six hours for discretionary reading).[40]

Reading behavior appears to be related to good mental health and a well-adjusted life style.[41] The early environment of an individual (first six to ten years) is a primary influence toward stimulating a capability to think in a divergent manner.[42] A college education usually enhances this capacity.

Teaching students to read is teaching them to think. Those who think, read.[43] It may be too early to know if computer technology can teach students to think. Indeed, many teachers ask themselves a similar question: "Have I made a difference?" Computers store facts, and humans change or modify facts by conceptual revolutions.[44]

Lewis Mumford, when he was 84 years old, made an observation about academic scholarship that is also most appropriate for computer technology. Mumford said, "Academic scholarship, in its efforts to be scrupulously correct, to be faithful to the text, to pass on only certified truths, too often keeps

remote from the student the process of thinking itself, and defrauds the beginner of one of the great incentives to creativity: his bearing witness to the birth of an idea in another mind."[45]

Reading books provides ideas, and many prominent individuals have turned to books for insight into major problems. One of John F. Kennedy's first acts in the White House was to order 200 books placed on his office shelves for easy access. He called Barbara Tuchman's The Guns of August his presidential handbook due to the clear story of ignorance leading to misjudgment and then to catastrophe. Kennedy's recollection of The Guns of August was, according to him, a most influential factor during the Cuban missile crisis of October 1962.[45] Theodore Roosevelt (TR) was quite impressed with Upton Sinclair's muckracking novel, The Jungle, which graphically exposed conditions in the meat packing industry. As a direct result of this book's impact on TR, the Pure Food and Drug Act became law on June 30, 1906. TR read rapidly and widely; he also authored some 35 books and a staggering 150,000 letters.[47]

Harry Truman also liked to read, and he particularly enjoyed history. George Marshall read quite a bit and thought a lot about what he read. Lyndon B. Johnson took a speed reading course, but confined his reading to government memos and official documents. Herbert Hoover read slowly and limited his efforts to technical material. Calvin Coolidge liked to read the comics and

on occasion, when he went on vacation, had someone call King Features to learn what was going to happen to Ella Cinders or Orphan Annie. Dwight D. Eisenhower enjoyed westerns, and he especially liked Ernest Haycox westerns. Ike sometimes requested galley proofs be sent to him. Moe Berg, the Boston Red Sox catcher, knew three languages and read books in all of them; he later worked for the Central Intelligence Agency. In the Senate, J. William Fulbright, Wayne Morse, and Paul Douglas read constantly on numerous topics.[48]

One of the most prolific readers and perhaps the best example of how reading can expand intellectual powers is Eric Hoffer. Hoffer taught himself to read English and German at the age of five. After working at odd jobs in manual labor for 20 years, he joined the International Longshoreman's and Warehousemen's Union in San Francisco in 1942 when he was 40 (this was his first regular job). He worked at this job for 25 years. He had no mentor or formal education, but he continued to read books from the public libraries of California until he died this year at 80. Hoffer also taught himself how to write; he published eight books and numerous articles while working as a longshoreman. Reading and independent study seem to be the key to Hoffer's intellectual development and literary success.[49]

Summary

Computer technology from Charles Babbage's 1822 analytical engine to sophisticated minicomputers in the 1980s represents

in some measure the power of technical progress. William Barrett's suspicious nature of technology represents a serious criticism and could be the basis of legitimate concern: "Technology in the twentieth century has taken such enormous strides beyond that of the nineteenth that it now bulks larger as an instrument of naked power than as an instrument for human well-being.[50]

As an instrument of naked power, computers keep our monistic, electronic nervous system moving extremely fast within an environment restricted by nature, i.e., human abilities. If reading specialists can be relieved from the tedium of routine developmental tasks through the use of computer technology, then good. If computers are used as a substitute for teacher interaction, then subtle limits (affective concerns) will be established during student development. Eric Hoffer has expressed this requirement for human contact in cogent terms: "Even without censorship literature and art will not thrive where there are no friendship, no free conversations, no shame and no extravagant dreams."[51]

Computers only have the power that humans bestow to them. Once in power, computers force individuals into preselected technical paradigms that are synthetic creations. Human thoughts are vicariously filtered through the computer back and forth with defined combinations. This kind of exchange may condition a student to master the computer without an understanding of purpose

or a knowledge of human limitations. It enriches the spirit without touching the soul.

Computers in a reading laboratory will not be able to provide intellectual stimulation at levels expected from academic classroom participation. Initiative and careful analysis are parts of a disciplined, somewhat creative process within education. Moreover, computers might prove to be restrictive, rigid, and foster mechanical patterns of thought. William Carlos Williams once said the only human value of anything is intense vision of the facts.[52] The element of creativity or independent thought will always be difficult to simulate through a machine. For all the mechanical elegance available to us, there will always be problems a computer cannot solve.

There are no short cuts to being educated or learning how to read. Reading books, thinking, and reasoning through problems are developmental tasks requiring considerable individual effort. With soft, plain words William Faulkner put it this way, "I learned that, to be a writer, one has got to be what he is, what he was born."[53] The goal is a person who can think for herself or himself independent of programmed learning techniques whether they be in the form of simple written instructions or fancy electro-mechanical devices.

An education can produce independent thinkers, and it can also produce narrow conformists. There will always be a

need to go beyond the computer for our answers. When we fail to do this, our lives will merely be an extension of our machines, and conforming will be a major educational objective.

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